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ORIGINAL ARTICLE

Course and Prognosis of Knee Complaints in General Practice

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Objective. **Patients frequently present with knee complaints in general practice. Information about the course and prognosis of knee complaints is needed to inform patients and facilitate decisions on referral and treatment. The objective of the study was to assess the course of knee complaints and to identify predictors of outcome in patients visiting their general practitioner with a new episode of knee complaints.**

Methods. **Data were collected by means of self-administered questionnaires. After 3 and 12 months of followup, the following outcomes were assessed: perceived recovery, change in pain, and change in physical functioning. As potential predictors of outcome, several sociodemographic variables, characteristics of the symptom, baseline scores of the outcome measures, and intra- and extra-individual variables were analyzed using multiple regression analyses.**

Results. **We included 251 patients with a new episode of knee complaints presented in general practice. Only 25% reported recovery after 3 months, increasing to 44% after 12 months. A history of knee complaints, a longer duration of the current episode of knee complaints, other coexisting musculoskeletal complaints, and a higher level of distress were associated with a worse prognosis. In the linear regression models, 41–53% of the variance in pain reduction and improvement in functioning could be explained by the predictors. The area under the receiver operating characteristic curves, estimating the predictive accuracy of the Cox regression models concerning perceived recovery, was 0.77 after 3 months and 0.72 after 12 months.**

Conclusion. **Many patients did not recover after 12 months. Distress was found to be strongly associated with less pain reduction and less improvement in functioning.**

KEY WORDS. Knee complaints; Prognosis; General practice.

INTRODUCTION

Knee complaints are a serious problem because of their high prevalence and substantial impact on functional disability, health care costs, sick leave, and work disability (1–4). A recent survey among the Dutch general population showed that the 12-month period prevalence of knee pain can be estimated at 22% and that this prevalence increases with age (5). Given the recent demographic changes, one may expect that prevalence and incidence will increase in the near future. Approximately 33% of individuals reporting knee complaints during the preceding year indicated that they had contacted their general practitioner (GP) about these complaints (5), which means that the GP is frequently confronted with patients with knee complaints. The Second Dutch National Survey of General Practice (NS2) (6) showed that incidence rates of knee complaints presented to the GP are highest among all lower extremity complaints: 21.4 per 1,000 person-years for women and 22.8 per 1,000 person-years for men (7).

In Dutch public health care, the GP serves as a gatekeeper because all referrals to specialists, physiotherapists, and most other health care providers need to be initiated by a GP. This implies that the GP needs to distinguish complaints that require specialist care from those that can be managed in primary care. Such decisions require information about the likelihood of developing chronic pain and disability. However, information about predictors of the prognosis of knee complaints is limited.

A few potential predictors of the course of knee complaints can be derived from the available evidence. These

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include the severity and duration of the complaint and some intra-individual and extra-individual (environmental) factors such as smoking, comorbidity, and working status (8–10). So far, the majority of research has evaluated the predictive value of clinical characteristics (symptoms and signs), whereas little attention has been given to the predictive value of psychosocial factors. Psychosocial variables have been shown to be related to a high risk of chronicity in musculoskeletal illness in general (11,12) and to a decrease in functional status in rheumatoid arthritis (13). Avoidance of activity has been shown to be associated with disability in patients with osteoarthritis of the knee (14). Besides other potential predictors, the predictive value of psychosocial factors such as pain coping, distress, kinesiophobia, and social support was also investigated in the present study. The objective of the present study was first to assess the course of knee complaints in adult primary care patients, and secondly to identify predictors of outcome in patients reporting a new episode of knee complaints.

PATIENTS AND METHODS

Design and data collection. We conducted a prospective cohort study in 61 general practices (97 GPs) in the Netherlands. The GPs who participated in this study are considered to be representative of all Dutch GPs. Forty-nine GPs from 27 practices participated in the NS2, which was carried out by the Netherlands Institute for Health Services Research in cooperation with the National Information Network of General Practice in 2001 (15). Patients were eligible for participation in our study if they met the following inclusion criteria: visited their GP with a new episode of knee complaints, were 18 years or older, were capable of filling in Dutch questionnaires, and signed informed consent. An episode was considered new if patients had not visited their GP for the same complaint during the preceding 3 months. Patients were excluded from the study if a fracture, malignancy, prosthesis, amputation, or congenital defect was considered to be the cause of the complaint at issue or if a patient was pregnant. Patients who were eligible for participation were informed about the study by their GP, and with their approval, their names and addresses were sent to the Institute for Research in Extramural Medicine. At baseline and after 3 and 12 months of followup, individual patient data were collected by means of self-administered questionnaires. Further details about the design of the study are described elsewhere (16). The Medical Ethics Committee of the VU University Medical Center approved the study protocol.

The disablement process of Verbrugge and Jette (17) was used as a framework for studying predictors and outcomes in the present study (Figure 1). This conceptual model describes how chronic and acute conditions affect functioning in specific body systems, fundamental physical and mental actions, and activities of daily life. Furthermore, it describes the intra- and extra-individual factors that may influence physical functioning.

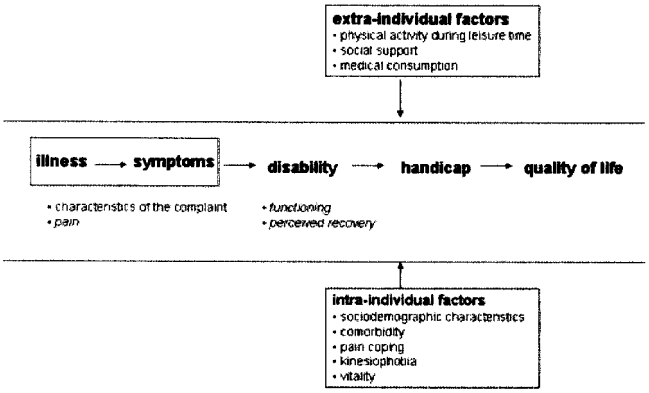

Figure 1. Conceptual framework

Outcome measures. Three outcomes were assessed after 3 and 12 months of followup. Perceived recovery was measured at 3 and 12 months of followup by asking the following question: "Is the knee complaint, for which you visited your GP 3/12 months ago, still bothering you?" (response options: yes or no). Pain intensity and functioning were measured at baseline and after 3 and 12 months of followup. Pain intensity was measured on an 11-point numerical rating scale (where 0 = no pain and 10 = very severe pain). Functioning was measured using the physical functioning subscale of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) (18,19), which was standardized to a score of 0–100, with lower scores indicating better functioning. Changes in pain intensity and functioning were calculated by subtracting the 3-month or 12-month followup score from the baseline score. Higher change scores indicated less pain or better functioning after 3 or 12 months of followup.

Potential predictors. The baseline questionnaire included questions about a wide range of potential predictors of outcome of knee complaints. These predictors included sociodemographic characteristics, characteristics of the symptom, perceived pain intensity and functioning, and several intra- and extra-individual factors (Table 1). The sociodemographic characteristics that were assessed as potential predictors included age, sex, body mass index (BMI), smoking status, work status, marital status, children (<5 years) in household, and education.

Characteristics of the complaint included questions about duration, location, history, severity, and perceived cause of the complaint. Patients were asked what they thought had caused their complaint (e.g., overload, injury, illness). The association of each possible cause with outcome was analyzed separately. The baseline scores on the pain scale and the pain, stiffness, and physical functioning subscales of the WOMAC were also analyzed as potential predictors.

Several intra-individual factors were measured, including presence of menopause, use of pain medication, pain coping strategies (6 subscales from the Pain Coping Inventory, with a higher score indicating more use of the strategy [20]), distress (short-version subscale from the Four Dimensional Symptom Questionnaire, with a higher score indicating more distress [21]), kinesiophobia (2 subscales

Table 1. Patient characteristics at baseline (n = 251)*

Patient characteristics	Baseline scores
Sociodemographic	
Age, mean ± SD years	49.3 ± 16.2
Male sex	51
Body mass index (weight/height^2), mean ± SD	26.3 ± 4.0
Present or previous smoker	63
Working	58
Living together/married	73
Have children in household	43
Have children <5 years in household	20
Education	
Primary	34
Secondary	51
College/university	15
Characteristics of the knee complaint	
Location of the knee complaint, 1 knee	83
Duration of the knee complaint	
<1 week	7.3
1–2 weeks	14.2
3–4 weeks	15.7
1–2 months	15.3
3–6 months	16.9
>6 months	30.6
Had knee complaint before	49
Severity of the knee complaint	
Almost always bothering	39
Regularly bothering	24
Now and then bothering	26
Not bothering	11
Perceived cause of the knee complaint	
Overload during usual activities	24
Overload during unusual activities	8
Overload during exercise	16
Injury during exercise	9
Injury	9
Stress	3
Illness	2
Unknown	25
Other	26
Baseline scores, mean ± SD	
Pain on an 11-point numerical rating scale	4.4 ± 2.4
WOMAC subscale pain (range 0–100)	37.9 ± 20.6
WOMAC subscale stiffness (range 0–100)	38.7 ± 26.7
WOMAC subscale functioning (range 0–100)	35.2 ± 22.6
Intra-individual factors	
In menopause	7
Taking pain medication	42
PCI 1 (pain transformation, range 4–16), mean ± SD	8.1 ± 2.8
PCI 2 (distraction, range 5–20), mean ± SD	10.3 ± 3.1
PCI 3 (reducing demands, range 3–12), mean ± SD	6.0 ± 2.0
PCI 4 (retreating, range 7–28), mean ± SD	10.3 ± 3.5
PCI 5 (worrying, range 9–36), mean ± SD	14.7 ± 4.2
PCI 6 (resting, range 5–20), mean ± SD	9.3 ± 2.8
Distress (4DSQ subscale, range 0–12), mean ± SD	3.8 ± 3.0
Kinesiophobia 1 (fear and avoidance of activity, range 0–100), mean ± SD	49.9 ± 17.0
Kinesiophobia 2 (importance of activity, range 0–100), mean ± SD	42.7 ± 22.8
Perceived general health (SF-36, range1—5), mean ± SD	2.6 ± 0.9
Quality of life (5-point scale), mean ± SD	2.5 ± 0.8
Vitality (subscale SF-36, range 0–100), mean ± SD	64.1 ± 16.6
Coexisting musculoskeletal complaints	
Only a knee complaint	44
More complaints of the lower extremities	9
Musculoskeletal complaints of both upper and lower extremities	47
Comorbidity	39
Extra-individual factors	
Meet norm for ACSM position stand	17
Meet norm for healthy activity	42
Social support (Social Support Scale, range 12–60), mean ± SD	18.6 ± 7.5

* Values are the percentage, unless otherwise indicated. WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; PCI = Pain Coping Inventory; 4DSQ = Four Dimensional Symptom Questionnaire; SF-36 = Medical Outcomes Study 36-item Short Form Health Survey; ACSM = American College of Sports Medicine.

based on items derived from the Tampa Scale [22] and the Fear-Avoidance and Beliefs Questionnaire [23], with a higher score indicating more kinesiophobia), and quality of life (measured on a 5-point rating scale, with a higher score indicating better quality of life). Perceived general health and vitality were measured using subscales from the Medical Outcomes Study 36-Item Short Form Health Survey (24), with a higher score indicating better general health or more vitality. Comorbidity was measured using a list of complaints and diseases (25), and other coexisting musculoskeletal complaints were assessed using a checklist.

Several extra-individual factors were measured using the following questions/questionnaires. To measure physical activity, we asked if patients met the Norm for Healthy Activity, which recommends that all adults should accumulate ≥30 minutes of moderate-intensity physical activity on at least 5 days of the week (26,27). Furthermore, we measured whether patients met the American College of Sports Medicine (ACSM) position stand, which recommends heavy physical exercise or sports at least 3 times a week (28). Social support was measured using the Social Support Scale (29), with a higher score indicating less social support.

In principle, potential predictors were analyzed in their original form as dichotomous or continuous variables. In case of a nonlinear relationship of the predictor with the outcome, tertiles were created and the predictor was analyzed as a categorical variable. This applied to the following variables: several coping strategies, distress, and the 2 kinesiophobia subscales.

Statistical analyses. The course of the knee complaints was described by means of descriptive statistics in terms of perceived recovery (%) and mean changes on the pain, stiffness, and physical functioning subscales of the WOMAC. Multiple regression analyses were used to predict outcome after 3 and 12 months of followup. To predict perceived recovery, Cox proportional hazards analysis was used with equal survival times for all patients. To predict changes in pain intensity and functioning, linear regression analysis was used. Finally, a subgroup analysis was performed to predict recovery in 2 age groups (<50 years versus ≥50 years) because degenerative knee complaints are usually seen in older patients, who may have a different prognosis.

First, univariate analyses were performed in which the association of all potential predictors with the outcome at issue were analyzed one by one. All predictors with a P value less than 0.20 in the univariate analysis were included in the multiple regression model. Next, multiple regression models were constructed using a stepwise backwards elimination. Starting with all predictors with a P value less than 0.20, the variable showing the least significant association with the outcome was manually excluded from the model. The model was considered complete if all variables in the model showed significance levels <0.10. If the number of variables to be entered in the model exceeded n/10, the variables were entered in groups. First, all sociodemographic predictors were entered, and all predictors with P values less than 0.20 were retained. Subsequently, predictors concerning characteristics of the symptom were added, and finally intra- and extra-individual factors were added.

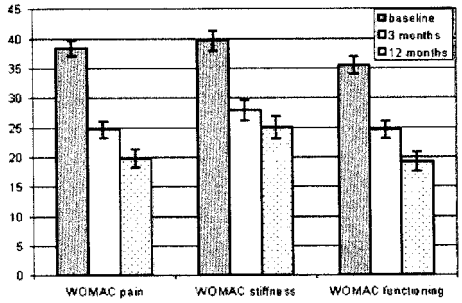

Figure 2. Mean Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores (range 0–100) in patients with knee complaints in general practice. Error bars are SE.

To estimate the predictive accuracy of the Cox regression models, individual survival functions were calculated and converted into individual probabilities of recovery. These probabilities were used to construct receiver operating curves (ROCs) for which the area under the curve and the 95% confidence interval (95% CI) were calculated. The proportion of explained variance (R^2) was calculated to assess the goodness of fit of the linear models.

RESULTS

At baseline, 251 patients with a new episode of knee complaints who presented in general practice were enrolled in the study and completed the baseline questionnaire. Of the 251 included patients, 89% returned the questionnaire after 3 months and 81% after 12 months. Baseline characteristics of the patients are shown in Table 1. The dropouts did not differ from the responders concerning age, sex, and baseline pain and WOMAC scores (data not shown).

Course of knee complaints. After 3 months of followup, 25% of the patients indicated that they had recovered from their complaints. This proportion increased to 44% after 12 months. The mean pain intensity scores declined during the study period. The mean ± SE pain intensity score was 4.5 ± 0.15 at baseline, 3.1 ± 0.17 after 3 months (32% reduction, $P < 0.01$), and 2.4 ± 0.19 after 12 months (47% reduction, $P < 0.01$).

The course of the WOMAC scores is shown in Figure 2. All subscales showed statistically significant improvements after 3 and 12 months ($P < 0.01$). The mean WOMAC pain score had improved by 36% after 3 months and 48% after 12 months. WOMAC functioning improved by 31% after 3 months and 46% after 12 months. The mean WOMAC stiffness score had improved by 30% after 3 months and 37% after 12 months. After 12 months, the mean WOMAC stiffness score was not statistically different from the mean score at 3 months of followup.

Predictors of outcome. The variables that showed a significant association with recovery, change in pain inten-

Table 2. Results of the univariate analyses: significant predictors ($P < 0.20$), entered in multiple regression analysis*

Predictors	After 3 months			After 12 months		
	Recovery HR† (95% CI)	Change in pain β‡ (95% CI)	Change in functioning β‡ (95% CI)	Recovery HR† (95% CI)	Change in pain β‡ (95% CI)	Change in functioning β‡ (95% CI)
Sociodemographic						
Age	0.98 (0.97, 1.00)		−0.21 (−0.40, −0.03)			−0.29 (−0.48, 0.09)
Sex	0.55 (0.32, 0.94)	0.70 (−1.41, 0.01)	−4.79 (−10.79, 1.21)			
BMI				0.95 (0.90, 1.01)		
BMI >30		0.84 (−0.13, 1.81)			1.02 (−0.03, 2.07)	5.47 (−2.80, 13.74)
Working						4.26 (−2.09, 10.61)
Having children			5.92 (−0.20, 12.03)	1.34 (0.88, 2.03)		7.54 (1.23, 13.85)
Having children <5 years					1.43 (−0.29, 3.15)	
Education (higher vs lower)				1.58 (0.87, 2.85)		
Characteristics of the knee complaint						
Location of the knee complaint	0.37 (0.13, 1.01)			0.35 (0.15, 0.80)	−1.03 (−2.08, 0.01)	
Duration of the knee complaint	0.76 (0.65, 0.89)	−0.20 (−0.42, 0.02)	−3.75 (−5.55, 1.94)	0.85 (0.75, 0.96)	−0.19 (−0.43, 0.05)	−3.74 (−5.57, 1.91)
Had knee complaint before	0.39 (0.22, 0.69)	−0.73 (−1.44, −0.02)	−6.03 (−12.01, −0.05)	0.47 (0.30, 0.74)	−1.19 (−1.97, −0.41)	−8.97 (−15.12, −2.82)
Severity of the knee complaint	1.45 (1.13, 1.86)			1.31 (1.09, 1.59)	0.29 (−0.09, 0.66)	
Cause: overload during usual activities		0.56 (−0.28, 1.40)				
Cause: overload during unusual activities		−1.65 (−2.99, −0.32)				
Cause: overload during exercise						−7.71 (−16.46, 1.05)
Cause: injury during exercise		1.17 (−0.10, 2.45)		1.60 (0.87, 2.94)	1.19 (−0.20, 2.58)	9.86 (−1.06, 20.78)
Cause: illness		−2.24 (−4.44, −0.04)				
Cause: other				0.62 (0.36, 1.07)		
Baseline scores of outcome measures						
Pain	0.92 (0.83, 1.03)	0.59 (0.46, 0.73)	2.75 (1.53, 3.98)	0.92 (0.98, 1.00)	0.61 (0.46, 0.75)	3.08 (1.82, 4.35)
WOMAC pain		0.04 (0.02, 0.06)	0.34 (0.20, 0.47)	0.99 (0.98, 1.00)	0.28 (0.01, 0.05)	0.33 (0.19, 0.48)
WOMAC stiffness	0.99 (0.98, 1.00)	0.02 (0.01, 0.03)	0.22 (0.11, 0.33)	0.99 (0.98, 1.00)		0.14 (0.02, 0.25)
WOMAC function		0.04 (0.02, 0.05)	0.53 (0.42, 0.64)	0.99 (0.98, 1.00)	0.02 (0.00, 0.04)	0.47 (0.35, 0.59)
Intra-individual variables						
Being in menopause	2.60 (1.00, 6.76)					
Taking pain medication						−4.74 (−11.05, 1.57)
PCI 1: pain transformation-middle vs lowest tertile		0.95 (0.10, 1.80)	6.45 (−0.80, 13.71)			2.70 (−4.60, 9.99)
Highest vs lowest tertile		0.25 (−0.67, 1.17)	2.57 (−5.23, 10.38)			5.54 (−2.63, 13.71)
PCI 2: distraction-middle vs lowest tertile	0.72 (0.38, 1.35)			0.81 (0.49, 1.34)	−0.01 (−0.98, 0.96)	
Highest vs lowest tertile	0.60 (0.32, 1.14)			0.69 (0.41, 1.15)	−1.09 (−2.05, −0.14)	
PCI 3: reducing demands-middle vs lowest tertile			1.37 (−6.74, 9.48)			7.07 (−1.01, 15.14)
Highest vs lowest tertile			7.31 (0.46, 14.16)			10.50 (3.55, 17.45)
PCI 4: retreating-middle vs lowest tertile		0.39 (−0.54, 1.32)	5.74 (−2.14, 13.62)		0.81 (−0.21, 1.83)	11.48 (3.48, 19.48)
Highest vs lowest tertile		0.68 (−0.15, 1.51)	6.97 (−0.02, 13.94)		0.23 (−0.68, 1.13)	6.92 (−0.11, 13.95)
PCI 5: worrying-middle vs lowest tertile						0.50 (−7.19, 8.19)
Highest vs lowest tertile						5.15 (−2.35, 12.65)
Distress-middle vs lowest tertile		0.38 (−0.50, 1.27)	3.12 (−4.35, 10.59)		−0.20 (−1.18, 0.78)	2.53 (−5.22, 10.28)
Highest vs lowest tertile			−10.64 (−24.58, 3.30)		−3.68 (−5.82, −1.54)	−24.35 (−41.25, 7.46)

Kinesiophobia - fear and avoidance of activity						
Middle vs lowest tertile		0.68 (−0.17, 1.52)	6.62 (−0.51, 13.74)			0.65 (−6.75, 8.05)
Highest vs lowest tertile		−0.16 (−1.06, 0.73)	6.63 (−0.87, 14.14)			6.55 (−1.22, 14.33)
Kinesiophobia - importance of exercise						
Middle vs lowest tertile		0.69 (−0.19, 1.57)				
Highest vs lowest tertile		0.23 (−0.64, 1.09)				
General health				0.80 (0.64, 1.01)		
Quality of life				0.76 (0.59, 0.99)	−0.50 (−0.99, 0.00)	
Vitality				1.02 (1.00, 1.03)	0.02 (0.00, 0.05)	
Coexisting musculoskeletal complaints						
Lower extremity complaint vs only knee complaint	0.69 (0.24, 1.94)	−0.73 (−2.10, 0.64)	−8.21 (−19.69, 3.28)	0.81 (0.36, 1.78)	−0.83 (−2.32, 0.67)	−10.07 (−21.78, 1.63)
Lower and upper vs only knee complaint	0.58 (0.33, 1.02)	−0.56 (−1.31, 0.19)	−4.83 (−11.12, 1.46)	0.75 (0.48, 1.16)	−0.77 (−1.60, 0.07)	−6.72 (−13.26, 0.18)
Comorbidity				0.60 (0.38, 0.96)	−0.78 (−1.59, 0.03)	−4.34 (−10.77, 2.10)
Extra-individual variables						
ACSM position stand	1.56 (0.85, 2.85)	0.73 (−0.21, 1.67)	6.66 (−1.25, 14.58)	1.69 (1.04, 2.76)		
Norm for healthy activity		0.52 (−0.21, 1.24)		1.37 (0.91, 2.08)	0.62 (−0.17, 1.42)	
Social support	0.96 (0.91, 1.00)	0.05 (−0.10, 0.00)	−0.64 (−1.05, 0.22)		−0.05 (−0.11, 0.01)	−0.40 (−0.84, 0.04)

* HR = hazard ratio; 95% CI = 95% confidence interval; β = regression coefficient; BMI = Body Mass Index; vs = versus; see Table 1 for additional definitions.
† HR <1.00 = reduced probability of recovery compared with the reference group; HR >1.00 = increased probability of recovery compared with the reference group.
‡ $\beta > 0$ = greater reduction in pain or more improvement in functioning; $\beta < 0$ = less reduction in pain or less improvement in functioning.

sity, or change in functioning in the univariate analyses after 3 or 12 months are presented in Table 2. These predictors were considered in the multivariate analyses. Age, the duration of the knee complaint, previous episodes of knee complaints, severity of the knee complaint, and other coexisting musculoskeletal complaints showed a statistically significant association with all outcome measures after both 3 months and after 12 months.

Predictors of outcomes after 3 months. The variables that were independently associated with outcome in the multivariate models predicting recovery, change in pain intensity, and change in functioning after 3 months are presented in Table 3. Regarding recovery after 3 months, 4 variables were significant predictors of a favorable outcome: male sex, shorter duration of the knee symptom, lower score on WOMAC stiffness (i.e., less stiffness) at baseline, and menopause. The area under the ROC curve was 0.77 (95% CI 0.71, 0.84).

With respect to a change in pain intensity, the following variables were significant predictors of a favorable outcome (larger reduction in pain intensity) after 3 months: male sex, BMI >30, shorter duration of the knee complaint, overload during usual activities as perceived cause, no overload during unusual activities as perceived cause, more pain at baseline, less distress, no coexisting musculoskeletal complaints, and meeting the ACSM position stand recommendations (28). The multiple regression model explained 43% of the variance of change in pain intensity.

Concerning a change in functioning, the following variables were significant predictors of a favorable outcome (more improvement in functioning) after 3 months: younger age, male sex, shorter duration of the knee complaint, lower score on WOMAC pain (i.e., less pain) at baseline, higher score on WOMAC functioning (i.e., worse functioning) at baseline, low score on the pain coping subscale "reducing demands," no coexisting musculoskeletal complaints, meeting the ACSM position stand recommendations, and having more social support. The multiple regression model explained 53% of the variance of change in functioning.

Predictors of outcomes after 12 months. The variables that were independently associated with outcome in the models predicting recovery, change in pain intensity, and change in functioning after 12 months are presented in Table 4. Regarding recovery after 12 months, 2 variables were significant predictors of a favorable outcome: no previous episodes of knee complaints and a lower score on WOMAC pain (i.e., less pain) at baseline. The area under the ROC curve was 0.77 (95% CI 0.66, 0.79).

With respect to a change in pain intensity, the following variables were significant predictors of a favorable outcome (greater reduction in pain intensity) after 12 months: no previous episodes of knee complaints, injury during exercise as perceived cause, more pain at baseline, low score on the pain coping subscale "distraction," less distress, and higher vitality scores at baseline. The multiple

Table 3. Predictors of recovery (AUC = 0.77), change in pain intensity (R^2 = 0.43), and change in functioning (R^2 = 0.53) after 3 months*

Predictor	Analysis	Recovery		Change in pain intensity		Change in functioning	
		HR† (95% CI)	*P*	β‡ (95% CI)	*P*	β‡ (95% CI)	*P*
Sociodemographic							
Age, years	Continuous					−0.21 (−0.36, −0.06)	0.01
Female	Vs male	0.43 (0.23, 0.79)	0.01	−1.01 (−1.60, 0.42)	0.00	−8.00 (−12.53, −3.46)	0.00
BMI >30	Vs BMI ≤30			0.86 (0.06, 1.67)	0.04		
Characteristics of the knee complaint							
Duration of the knee complaint	Continuous	0.73 (0.62, 0.86)	0.00	−0.25 (−0.44, −0.07)	0.01	−2.58 (−4.01, −1.15)	0.00
Cause, overload during usual activities	Vs not			0.67 (−0.04, 1.37)	0.06		
Cause, overload during unusual activities	Vs not			−1.09 (−2.19, 0.02)	0.05		
Baseline scores							
Pain	Continuous			0.65 (0.53, 0.78)	0.00		
WOMAC pain	Continuous					−0.21 (0.39, −0.04)	0.02
WOMAC stiffness	Continuous	0.99 (0.98, 1.00)	0.00				
WOMAC functioning	Continuous					0.82 (0.66, 0.99)	0.00
Intra-individual							
Menopause	Vs not	2.94 (1.13, 7.67)	0.03				
PCI 3: reducing demands, middle tertile	Vs lowest tertile					−5.79 (−11.91, 0.34)	0.06
Highest tertile	Vs lowest tertile					−0.39 (−5.54, 4.76)	0.88
Distress, middle tertile	Vs lowest tertile			0.44 (−0.29, 1.16)	0.24	0.29 (−5.38, 5.95)	0.92
Highest tertile	Vs lowest tertile			−1.66 (−3.06, −0.26)	0.02	−17.40 (−29.10, −5.70)	0.00
Coexisting complaints lower extremity	Vs only knee complaint			−1.20 (−2.36, −0.03)	0.04	−2.65 (−11.52, 6.22)	0.56
Complaints of upper and lower extremity	Vs only knee complaint			−1.07 (−1.72, −0.41)	0.00	−5.19 (−10.36, −0.03)	0.05
Extra-individual							
Meeting ACSM position stand	Vs not meeting norm			0.77 (−0.01, 1.55)	0.05	5.83 (0.20, 11.87)	0.06
Social support	Continuous					−0.30 (0.63, 0.03)	0.08

* AUC = area under curve; HR = hazard ratio; 95% CI = 95% confidence interval; β = regression coefficient; vs = versus; see Table 1 for additional definitions.
† HR <1.00 = reduced probability of recovery compared with the reference group; HR >1.00 = increased probability of recovery compared with the reference group.
‡ β >0 = greater reduction in pain or more improvement in functioning; β <0 = less reduction in pain or less improvement in functioning.

Table 4. Predictors of recovery (AUC = 0.72), change in pain intensity (R^2 = 0.41), and change in functioning (R^2 = 0.44) after 12 months*

Predictor	Analysis	Recovery		Change in pain		Change in functioning	
		HR† (95% CI)	*P*	β‡ (95% CI)	*P*	β‡ (95% CI)	*P*
Sociodemographic							
Age, years	Continuous					−0.29 (−0.45, 0.12)	0.00
Characteristics of the knee complaint							
Duration of the knee complaint	Continuous					−2.71 (−4.19, −1.24)	0.00
Had knee complaint before	Vs not	0.51 (0.33, 0.81)	0.00	−1.31 (−1.94, −0.67)	0.00		
Cause: injury during exercise	Vs not			0.98 (0.12, 2.08)	0.08		
Baseline scores							
Pain	Continuous			0.69 (0.55, 0.82)	0.00		
WOMAC pain	Continuous	0.99 (0.98, 1.00)	0.02				
WOMAC stiffness	Continuous					−0.16 (−0.29, −0.03)	0.02
WOMAC functioning	Continuous					0.65 (0.50, 0.80)	0.00
Intra-individual							
PCI 2: distraction, middle tertile	Vs lowest tertile			−0.32 (−1.10, 0.47)	0.43		
Highest tertile	Vs lowest tertile			−1.02 (−1.80, −0.24)	0.01		
PCI 4 retreating, middle tertile	Vs lowest tertile					6.54 (0.18, 12.89)	0.04
Highest tertile	Vs lowest tertile					2.61 (−3.11, 8.33)	0.37
Distress, middle tertile	Vs lowest tertile			−0.34 (−1.15, 0.48)	0.42	−1.72 (−7.88, 4.45)	0.59
Highest tertile	Vs lowest tertile			−2.03 (−3.93, −0.12)	0.04	−28.16 (−42.41, −13.90)	0.00
Vitality	Continuous			0.02 (0.00, 0.04)	0.03		

* AUC = area under curve; HR = hazard ratio; 95% CI = 95% confidence interval; β = regression coefficient; vs = versus; see Table 1 for additional definitions.
† HR <1.00 = reduced probability of recovery compared with the reference group; HR >1.00 = increased probability of recovery compared with the reference group.
‡ β >0 = greater reduction in pain or more improvement in functioning; β <0 = less reduction in pain or less improvement in functioning.

regression model explained 41% of the variance of change in pain intensity.

Concerning a change in functioning, the following variables were significant predictors of a favorable outcome (more improvement in functioning) after 12 months: younger age, male sex, shorter duration of the knee complaint, lower score on WOMAC stiffness (i.e., less stiffness) at baseline, higher score on WOMAC functioning (i.e., worse functioning) at baseline, medium score on the pain coping subscale "retreating," and less distress. The multiple regression model explained 44% of the variance of change in functioning.

The subgroup analyses for patients younger or older than 50 years did not result in different predictors of outcome after 3 or 12 months followup (data not shown).

DISCUSSION

In the present study, the course of knee complaints presented in general practice was described and predictors of outcome were identified. The results showed that less than half of the patients with knee complaints reported recovery after 1 year of followup. Despite this low recovery rate, patients showed a mean reduction in pain intensity of 47% and a mean improvement in functioning of 46% after 12 months of followup.

Different predictors of the various outcomes at followup were found, but not one variable could be found that predicted a better prognosis for all outcome measures at 3 and 12 months of followup. A study on patients with low back pain has also found prognostic factors to differ when varying outcome measures or different durations of followup were used (30). We found similar results in patients with hip and upper extremity complaints (31–33). This may be caused by different mechanisms that may underlie the recovery of pain and disability in patients with musculoskeletal complaints.

As expected, patients with more pain at baseline experienced more pain reduction compared with patients with less pain at baseline. Similarly, patients with worse physical functioning at baseline experienced more improvement in physical functioning compared with those with better baseline physical functioning. We assume that this finding can be explained by the fact that there is more room for improvement in patients with higher scores at baseline.

A peculiar finding was that patients with a BMI >30 experienced more pain reduction after 3 months than patients with a BMI ≤30. This finding was unexpected because previous research has demonstrated that a higher BMI is associated with more knee pain or more joint pain in general (34,35). The cross-sectional associations found

in the studies of Pountain (34) and Aoyagi et al (35) may not necessarily hold when studying longitudinal changes in pain, but it is difficult to offer a plausible explanation for better outcome in patients with a high BMI. Because the effect of a high BMI found in our study was small (<1 point on the pain scale, ranging from 0 to 10), this association may be a random finding.

A longer duration of the knee complaint was associated with worse outcomes on all outcome measures after 3 months and with less improvement in functioning after 12 months. Previous episodes of knee complaints were also associated with a poor prognosis concerning pain and recovery after 12 months. In addition, more stiffness at baseline was associated with less improvement in functioning after 12 months and a lower probability of recovery after 3 months. These associations confirm findings from previous research and may indicate that these patients have chronic conditions such as osteoarthritis or the consequences of knee injuries, conditions that have often been found to account for a worse prognosis (36–38). In our study, we were unable to collect information on medical diagnoses, therefore this hypothesis could not be tested. However, we performed a subgroup analysis to predict recovery in 2 age groups (<50 years versus ≥50 years) because degenerative knee complaints are usually seen in older patients and may have a different prognosis. No different predictors were found (data not shown). We did not find any indication that predictors would be different for degenerative versus nondegenerative knee complaints.

Some perceived causes of the symptom turned out to be significant predictors of a change in pain intensity. Patients who thought that the cause of their symptom was an injury or overload during usual activities showed more reduction in pain after 3 or 12 months than patients who did not consider these circumstances to be a probable cause of their symptom. Patients who thought that overload during unusual activities caused their complaint showed less pain reduction after 3 months. We had expected, however, that overload during unusual activities would be correlated with a favorable outcome because unusual activities can more easily be avoided than usual activities. The effects were not very large and were of borderline significance (Tables 3 and 4). Therefore, we believe that not too much weight should be given to our findings regarding perceived cause. These findings should be replicated in future studies.

To our knowledge, no previous studies have investigated the influence of psychosocial predictors on the prognosis of knee complaints in a general practice population. In our study, several pain coping strategies turned out to be significant predictors. Less improvement in functioning after 3 months was found for patients who scored high on the (active) pain coping strategy "reducing demands" (e.g., "I continue activities with less effort"), and less pain reduction after 12 months was found for patients who scored high on the (active) pain coping strategy "distraction" (e.g., "I do something I find pleasant"). In addition, more improvement in functioning was found for patients who scored high on the (passive) pain coping strategy "retreating" (e.g., "I retreat into a restful environment"). These findings seem to be in contrast with results of previous studies, which found that active coping strategies facilitate a better prognosis than passive coping strategies (39,40). We recommend further research on this subject to unravel the influence of different coping styles on recovery in relevant subgroups of patients with musculoskeletal problems.

High levels of distress predicted a poor outcome of pain and functioning after both 3 months and after 12 months. Patients with the highest levels of distress showed a smaller mean reduction in pain (2 points on a scale from 0 to 10) and a smaller mean improvement in functioning (28 points on a scale from 0 to 100) than patients with the lowest levels of distress after 12 months (Table 4). Other studies have found similar results in patients with other musculoskeletal complaints. Psychological distress was found to predict persistent pain in patients with musculoskeletal illness presented in a primary care setting (12,41). Furthermore, psychological distress was reported to be univariately associated with functional state in patients with osteoarthritis of the knee (42). In addition, distress has been shown to predict functional outcome after total knee replacement surgery (43) and to predict disability in patients with knee osteoarthritis (44). Because baseline levels of distress turned out to be such a strong predictor in our study, it might be considered for intervention. It might be interesting to investigate whether early intervention aimed at reducing distress can prevent persistent pain and functional problems in patients with knee complaints in a primary care setting.

Our study has certain limitations. In the analyses, we did not include occupational factors as potential predictors of outcome, although these factors have been shown to be risk factors for the occurrence of knee osteoarthritis (45). We did not examine these factors because 42% of the patients in our study did not have paid employment. Our objective was to develop models that can be applied to most patients with knee complaints in a general practice population. Examining occupational factors would create models that would not be relevant to nearly half of the patients seen by the GP.

In addition, many eligible patients did not participate in our study. The number of included patients per GP varied from 0 to 70, and 37 GPs (38%) included no patients at all. Active GPs (i.e., those who included at least 1 patient) who participated in the NS2 included more patients per GP than active GPs who did not participate in the NS2 (32 patients versus 12 patients), probably because those who participated in the NS2 used a computerized pop-up screen to remind them of the study. Based on data from the NS2, we estimated that a maximum of 40% of the eligible patients in the general practices that participated in the NS2 participated in our study. In the general practices that did not participate in the NS2, this percentage was probably lower. GPs indicated that the most important reasons for not including patients concerned the exclusion criteria and lack of time or motivation to ask all patients during consultation hours (46).

Furthermore, our study population was rather heterogeneous and included patients with many different types of knee complaints. The predictors that we identified applied to all patients in our study. Different additional predictors

of outcome may apply to different subgroups of patients. Identification of such subgroup-specific predictors may further enhance the predictive validity of the models. However, our study did not contain enough patients to perform analyses in relevant subgroups.

Although the content of the 6 models showed some variation, our study adds information that is relevant to the management of knee complaints in general practice. The results may help GPs provide patients with more accurate information regarding their prognosis. Patients who have had previous episodes of knee complaints, have had their complaint for a longer period, and report other coexisting musculoskeletal complaints seem to have a worse prognosis. Distress turned out to be a strong predictor of changes in pain and functioning both after 3 months and 12 months. Decreasing the patients' level of distress may improve the prognosis of patients with knee complaints. However, we wish to stress that, due to the observational design of our study, these results provide only preliminary evidence regarding a causal association between distress and recovery from knee complaints. Experimental studies are needed to test the hypothesis that reducing distress will lead to better outcomes.

Our findings are in agreement with the current attempt to increase the attention of GPs on these types of complaints (47). The Western population is aging, and more individuals are experiencing lower extremity complaints, especially knee pain. This study showed that most patients still had their knee pain after 1 year. Because knee pain has a substantial impact on individuals' lives (48) and on their use of primary health care resources (49), the need to identify practical and effective means of reducing this burden should be a priority for research and development in primary care. Future research should focus not only on physical interventions, but also on psychological interventions. Psychological distress might be considered a focus for future intervention studies.

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